

METHODOLOGY AND NOTES ON DATA SERIES

PURCHASING POWER PARITIES

Purchasing power parities (PPPs) are the preferred normalizer of international R&D data. Comparisons of international statistics on R&D are hampered by the fact that countries' R&D expenditures are denominated, obviously, in their home currencies. Two approaches are commonly used to normalize the data and facilitate aggregate R&D comparisons. The first method is to divide R&D by GDP, which results in indicators of relative effort vis-a-vis total economic activity. The second method is to convert all foreign-denominated expenditures to a single currency, which results in indicators of absolute effort. The first method is a straightforward calculation, but enables only gross national comparisons. The second permits finer inter-country comparisons, but first entails choosing an appropriate currency conversion series.

Since, for all practical purposes, there are not widely accepted R&D-specific exchange rates, the choice is between market exchange rates (MERS) and PPPs. These are the only series consistently compiled and available for a large number of countries over an extended period of time.

At their best, MERs represent the relative value of currencies for goods and services that are traded across borders—that is, MERs measure a currency's relative international buying power. But because sizable portions of most countries' economies do not engage in international activity, and because major fluctuations in MERs greatly reduce their statistical utility, an alternative currency conversion series—PPPs—has been developed. PPPs take into account the cost differences across countries of buying a similar basket of goods and services in numerous expenditure categories, including nontradables. The PPP basket is representative of total gross domestic product across countries. When applied to current R&D expenditures of major industrial countries such as Germany and Japan, PPPs result in a lower estimate of total research spending than do MERs. For example in 1994, Japan's R&D totaled \$76 billion based on MERs and \$54 billion based on PPPs. When applied to current R&D

expenditures of developing countries such as China and India, PPPs result in a larger estimate of total research spending than do MERs.

PPPs are the preferred international standard for calculating cross-country R&D comparisons and are used, for example, in all official OECD R&D tabulations. Although there is considerable difference in what is included in GDP-based PPP items and R&D expenditure items, the major components of R&D costs—fixed assets and the wages of scientists, engineers, and support personnel—are more suitable to a domestic converter than to one based on foreign trade flows. Exchange rate movements bear little relationship to changes in the cost of domestically performed R&D.

Changes in dollar-denominated R&D expenditures converted with market exchange rates exhibit wild fluctuations, and are inappropriate for showing trends. PPP calculations result in R&D expenditure changes considerably closer to the countries' actual funding pattern.

Japan's present national currency was converted to constant 1987 national currency and then converted to 1987 constant PPPs (\$PPP) using PPP conversion rates of the Organization for Economic Co-operation and Development (OECD).

OECD ADJUSTED DATA FOR JAPAN

The national survey in Japan collects data for researchers as "persons working mainly in R&D" rather than in terms of full-time equivalent. Consequently, R&D personnel and labor cost data are overestimated by international standards. Recent studies by the Japanese authorities suggest that in order to reach FTE the numbers of researchers might, perhaps, be cut by 40 percent in the higher education sector and by about 30 percent in the business enterprise sector and for the national total. Therefore, higher education R&D (HERD) would be reduced by about 25 percent and business enterprise R&D (BERD) and gross expenditure R&D (GERD) cut by about 15 percent.

For some years OECD has calculated an “adjusted” Japanese series of data for the higher education sector, based on proportions observed in other member countries (less 50 percent of researchers and hence about 35 percent of HERD) and, thus, for the national totals (less 12.5 percent researchers and 10 percent GERD) for use in its own reports. (See OECD Science and Technology Indicators No. 2—R&D, Invention and Competitiveness, p. 75.) This OECD series does not make any adjustment to the business enterprise sector.

OECD “adjusted” series include a special analysis of the Japanese Science and Technology Budget by socio-economic objective prepared for OECD by Japanese consultants. The latter excludes most R&D in the social sciences and humanities.

STOCK OF SCIENTISTS AND ENGINEERS

The 1990 Japanese data presented in tables 1 and 2 are based on the U.S. Bureau of the Census, 1996 publication of *Scientists and Engineers in Japan: 1990*, which provides the results of a 13-percent sample tabulation of the 1990 Japanese Population Census. The prior years of Japanese data presented are taken from the previous SRS 1988 publication: *The Science and Technology Resources of Japan: A Comparison with the United States*. The U.S. 1980 data are from this previous SRS publication, while the 1986 and 1991 U.S. data presented are from the U.S. Bureau of the Census 1992 publication *Scientists and Engineers in Industrialized Societies*, which uses a 3-percent sample from each national census.

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